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DRYING EAR CORN with HEATED AIR

Leaflet No. 333

U. S. DEPARTMENT OF AGRICULTURE

GRAIN DRYING ON THE FARM

Grain drying by mechanical ventilation removes many of the hazards of harvesting and storing crops. Such drying is valuable to you not only when faced with the emergency handling of high-moisture crops, but also as part of your regular crop-management program. Controlled drying fits in with modern production, harvesting, and handling methods. It overcomes the problems arising from the use of grain combines and mechanical corn harvesters—equipment that gets the crops out of the field quickly but often dangerously wet. The availability of electric and gasoline-engine power and use of such power in driers of modern design makes mechanical ventilation possible.

Crop drying is practical on the farm if the following advantages outweigh the cost of drying:

Corn can be—

1. Stored safely.
2. Marketed without a moisture discount.
3. Harvested early, thus taking advantage of good harvesting weather, reducing field losses from insects and bad weather, obtaining cleaner husking, lowering harvesting costs, and making possible fall plowing and seeding of wheat or cover crops.
4. Shelled and stored in tight bins in half the space required by ear corn, thus reducing storage loss caused by insects, rodents, and unfavorable weather.
5. Harvested with a picker-sheller.
6. Saved in wet years.

Small grains can be—

1. Stored safely.
2. Marketed without a moisture discount.
3. Harvested as soon as mature, thus reducing the chance of storm damage while waiting for the crop to dry in the field.
4. Harvested faster, by operating combines early in the morning and late at night.
5. Combined directly without windrowing.
6. Saved even in wet harvesting weather, when, because of late seeding or poor growing weather, the crop must be harvested although it contains a high percentage of moisture.

The way to dry grain[1] is explained in this leaflet and the three others here listed, copies of which are available from your county agricultural agent, the Extension Service agricultural engineer at your State college, or from the Office of Information, the U. S. Department of Agriculture, Washington 25, D. C.

Leaflet 331, "Drying Shelled Corn and Small Grain with Heated Air," tells how this job can be done successfully on the farm.

Leaflet 332, "Drying Shelled Corn and Small Grain with Unheated Air," outlines how unheated air can be used to reduce the moisture content of harvested grain to a point at which it can be stored safely on the farm or marketed without moisture discount.

Leaflet 334, "Drying Ear Corn with Unheated Air," explains how unheated air can be forced through ear corn with good drying results and at low cost.

If drying crops with mechanical ventilation is new to you, the advantages and disadvantages listed below for both unheated- and heated-air drying may help you in considering your drying set-up.

Heated-Air Drying

Advantages:	*Disadvantages:*
1. Can dry wettest grain.	1. Higher initial equipment cost.
2. Can dry regardless of weather conditions.	2. Expense for fuel.
3. Short drying time.	3. Some fire hazard.
4. High drying capacity per fan horsepower.	4. Considerable supervision required.

Unheated-Air Drying

Advantages:	*Disadvantages:*
1. No expense for fuel.	1. Dependent on weather conditions.
2. No fire hazard.	2. Slow drying rate; usually several weeks.
3. Lower initial equipment cost.	3. With drying prolonged, the grain may be damaged by mold growth.
4. Little supervision required.	

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[1] How to dry forage crops is described in Farmers' Bulletin 2028, "Drying Forage by Forced Ventilation."

Washington, D. C. Issued September 1952

Drying Ear Corn With Heated Air

EAR CORN can be dried for storage or market by mechanical ventilation with heated air in any kind of weather and from any moisture content. Fuel costs will be about in proportion to the amount of water to be removed from the corn and will vary with the weather (see tables 1 and 2).

General Recommendations

1. Harvest your corn as cleanly as possible. In filling the crib do not allow shelled corn, husks, and silks to accumulate in spots.
2. Arrange air ducts, or tunnels, to distribute air uniformly. The air should travel about the same distance through the corn in all parts of the crib.
3. In warm weather operate the drier day and night. In cool weather operate either continuously or in the daytime only. The total fuel required will be about the same. If you operate the drier in daytime only, cool the corn by letting the fan continue to run for an hour or so after the heat is shut off each evening.
4. As a general rule, drying-air temperatures should not be more than 130° to 140° F. In cold weather the drying air should be at least 60° warmer than the outdoor temperature. For seed corn, the drying-air temperature should not exceed 110°.
5. Match the size of the batch of corn to be dried at one time to the size of drier (see table 1).
6. Use good equipment with adequate safety controls and operate carefully. If you do this, the fire hazard will not be great. Check with your fire insurance agent to be sure that you have adequate coverage when using heated-air drying equipment.

Equipment Requirements

Equipment needed includes a heater such as an oil burner, a power-driven fan, and a crib or drying bin for the corn.

Several makes of crop driers are now on the market. Most of the driers are portable. Each unit consists of a power-driven fan, a heater, and suitable safety controls. The heater may burn oil, natural or liquefied petroleum (L. P.) gas, or coal. Such driers have two characteristics that determine their performance in drying grain: (1) The rate at which heat is supplied (rate of fuel consumption per hour) and (2) the rate of air supply in cubic feet per minute (c. f. m.).

Driers are classed as "direct heat" and "indirect heat." The types are illustrated in figures 1 and 2, respectively. At least two automatic safety controls are needed with either kind of drier. These controls are: (1) A device to shut off the drier if the flame fails, and (2) one to shut off the fuel supply if the temperature goes too high.

In the portable direct-heat crop drier shown in figure 1, burnt gases are combined with the heated air and the mixture is blown through the grain. This type of drier uses fuel efficiently, but there is some fire hazard.

In the portable indirect-heat crop drier shown in figure 2, the burnt gases are discharged through a smokestack. Air, heated as it comes into contact with the heat-exchanger, is blown through the grain. Some heat is lost through the smokestack. The fire hazard is less than with a direct-heat drier.

When selecting a fan, the most important factors to consider are suitable design, size, and speed. Of secondary importance is whether the fan is a propeller or centrifugal type. Some of the fans that are unsatisfactory for use in grain driers are house, attic, and barn-ventilating fans; those for blowing materials, such as silage and grain blowers; and those of a type used in grain-fanning mills. When a fan is made a part of a drier, its air-delivery rate is reduced as compared to that shown in fan tables. The air-delivery rating of the drier should therefore be expressed in cubic feet per minute against static pressure measured at the drier outlet. The static pressure when drying ear corn usually will be from a half to three-quarters of an inch, water gage.

Prepared by the Division of Farm Buildings and Rural Housing, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration. The research on which this publication is based was in cooperation with the agricultural experiment stations of Illinois, Iowa, and Indiana and with the Production and Marketing Administration, United States Department of Agriculture. Helpful suggestions were also received from agricultural engineers of other experiment stations, from Rural Electrification Administration, United States Department of Agriculture, and from the manufacturers of crop driers and fans.

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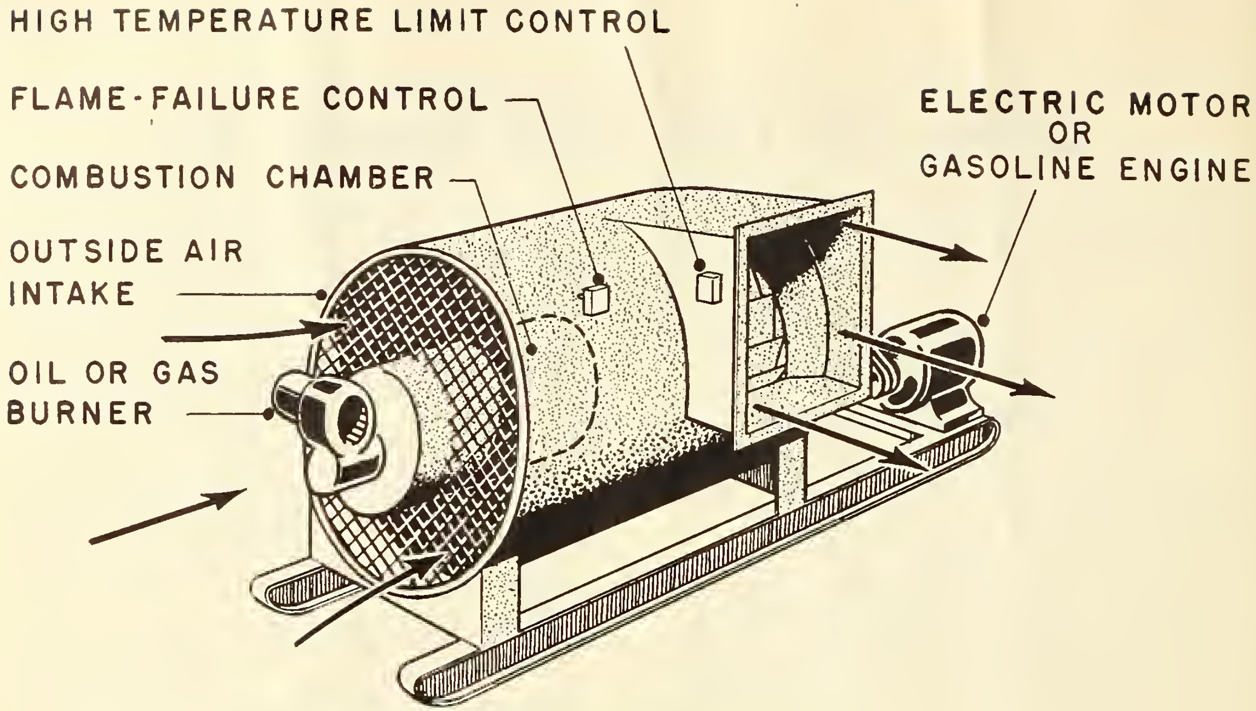


Figure 1.—*Portable direct-heat crop drier.*

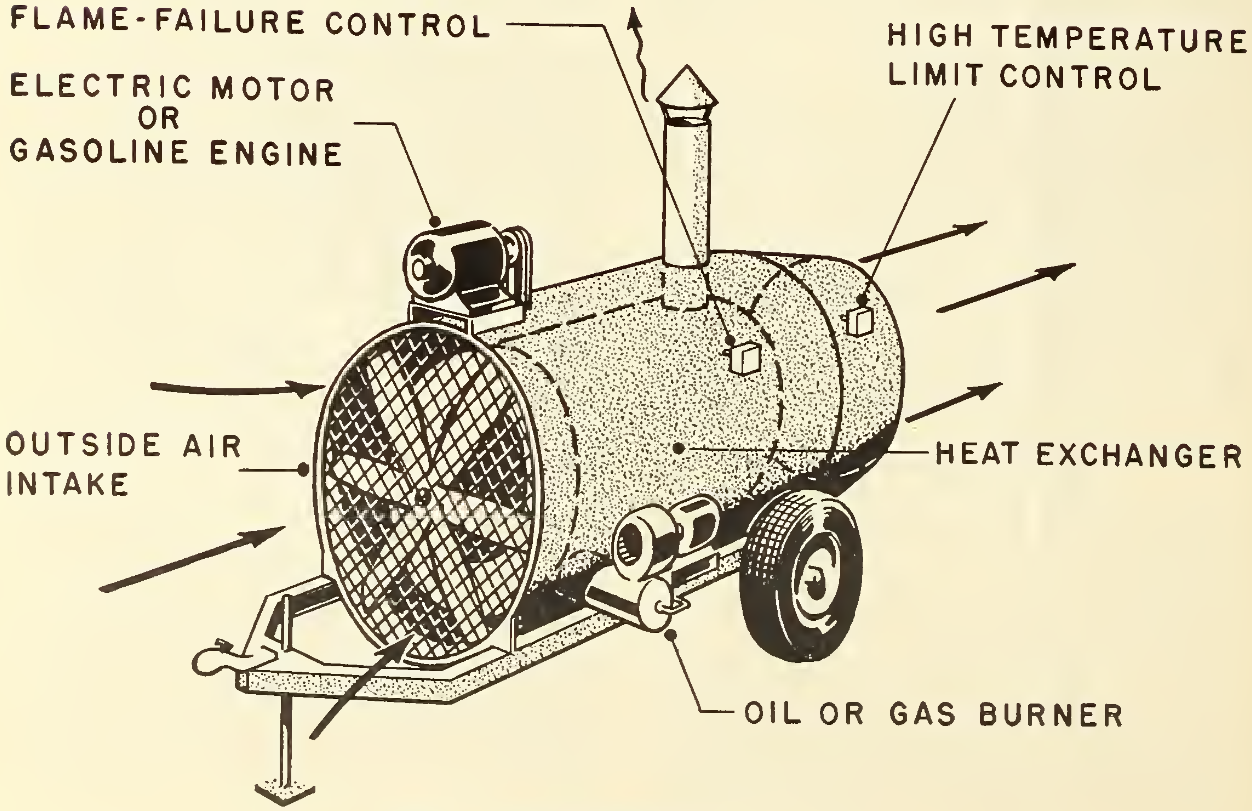


Figure 2.—*Portable indirect-heat crop drier.*

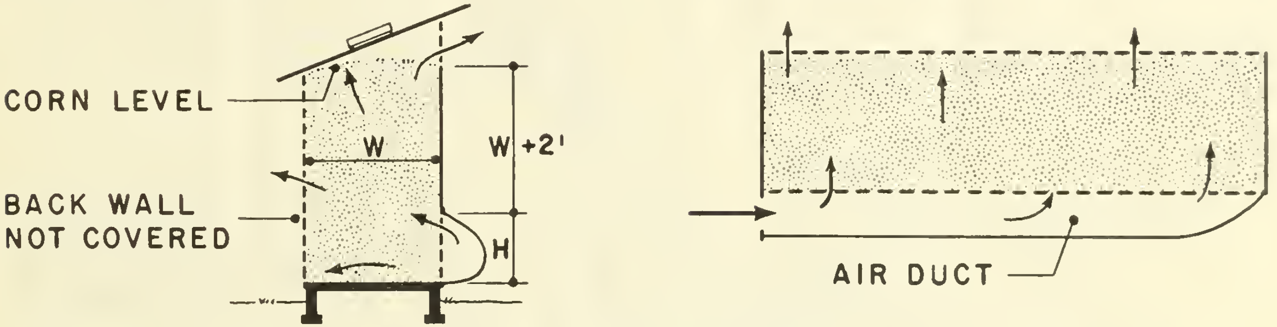
Husking and Cribbing Corn

Shelled corn, husks, and other material mixed with the ears tend to fill the spaces between ears and to interfere with air distribution. Air flow will bypass and fail to dry ears of corn where these materials accumulate. For this reason, husk the corn as clean as possible. Also, use a screen in the elevator; this will take out some of the shelled corn and also chaff and dirt. Unless the elevator drops the corn on a spreading device in the crib, move the elevator spout frequently, directing it so that any shelled corn will be deposited near the outside walls rather than in the middle of the crib.

Cribs, Bins, and Air Ducts

Various types of cribs, bins, and air-duct arrangements for use in drying and storing ear corn are illustrated in figures 3 through 15. Ducts and ventilators should have a cross section area of 1 square foot for each 1,000 c. f. m. of air delivered to the corn. The main duct throughout should be larger, therefore, than the fan outlet, and it should be free of sharp turns.

You can use canvas or reinforced paper, fastened with wooden strips about 2 feet apart and at right angles to the air flow, to enclose partly a crib of the type shown in figures 3, 4, or 5. Also place strips



DUCT HEIGHT (H) SHOULD BE AT LEAST 1/3 OF CRIB WIDTH (W)

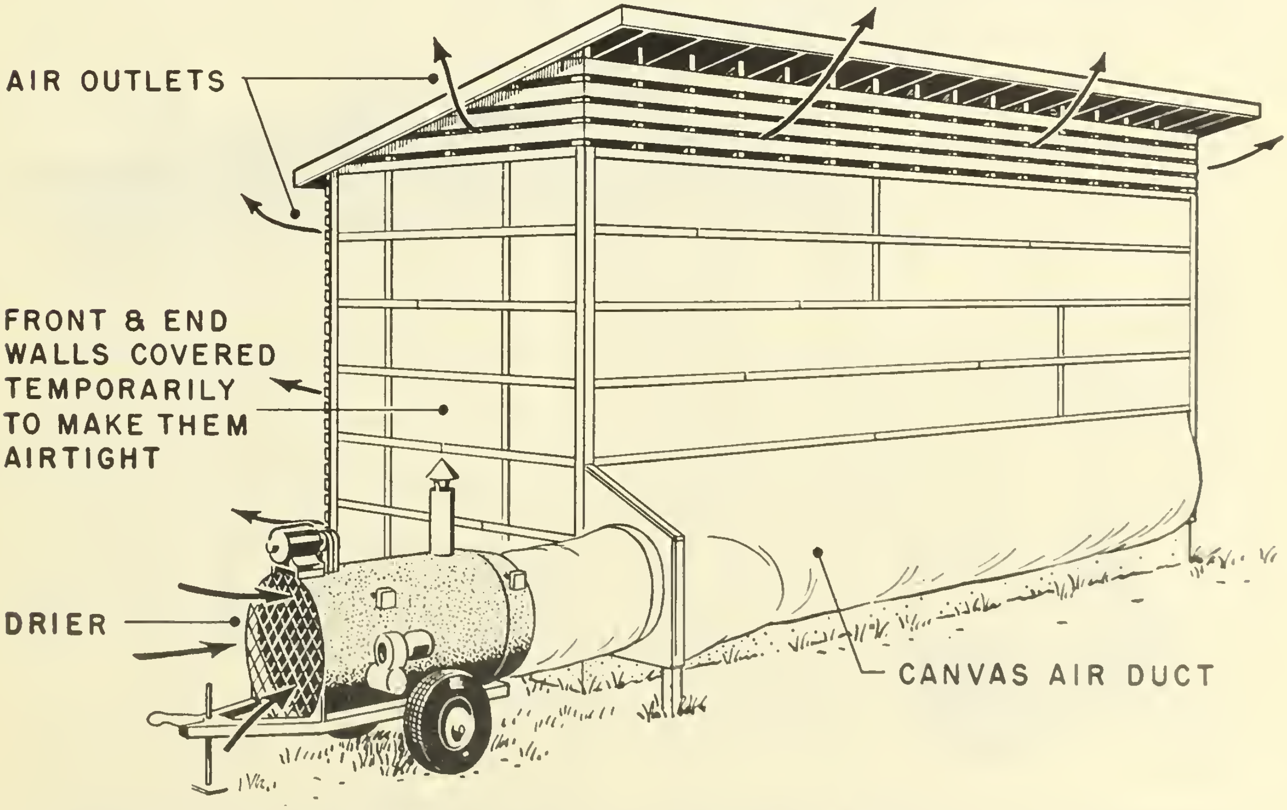

AIR OUTLETS
FRONT & END WALLS COVERED TEMPORARILY TO MAKE THEM AIRTIGHT
DRIER
CANVAS AIR DUCT

Figure 3.—*Single crib partly enclosed with canvas or reinforced paper. Air duct of canvas, outside the crib.*

over laps or joints. Canvas, as shown in figure 3, or reinforced paper over a light wooden frame makes a suitable air duct outside and along the front of the crib. You can attach the canvas or paper to the crib after it has been filled. Air blown into the duct moves across and upward through the corn and out the back and the upper part of the crib. After mechanical ventilation is complete, you can easily remove the wall covering and duct to permit normal ventilation of the corn.

A slatted or wire air duct has been installed on the inside of the crib shown in figure 4. You can use canvas or reinforced paper to enclose the crib in the same manner as for the crib in figure 3. The only difference is that the back of the crib in figure 4 has also been covered, so that air blown into the duct moves upward through the corn and then out the upper part of the structure. The diagram at top, left, of figure 4 shows the duct placed over a shelling trench. The trench must be airtight at the end opposite the fan.

You can prepare the large rectangular double crib shown in figure 5 for drying ear corn with heated air by closing the driveway doors and sealing them with reinforced paper. Or, you can place airtight bulkheads at each end of the driveway. If the end walls are not tight, cover them (shown as *a* in fig. 5), or cover the driveway walls (shown as *b*) back 6 to 8 feet from the crib ends. Covering the end walls is better.

If back of overhead bin wall studs are slatted, remove the slats or block the space to prevent short circuit of air. However, if height of overhead-bin wall in high cribs is greater than the crib width, leave some slats at the bottom of the bin-wall studs (shown as *c* in fig. 5).

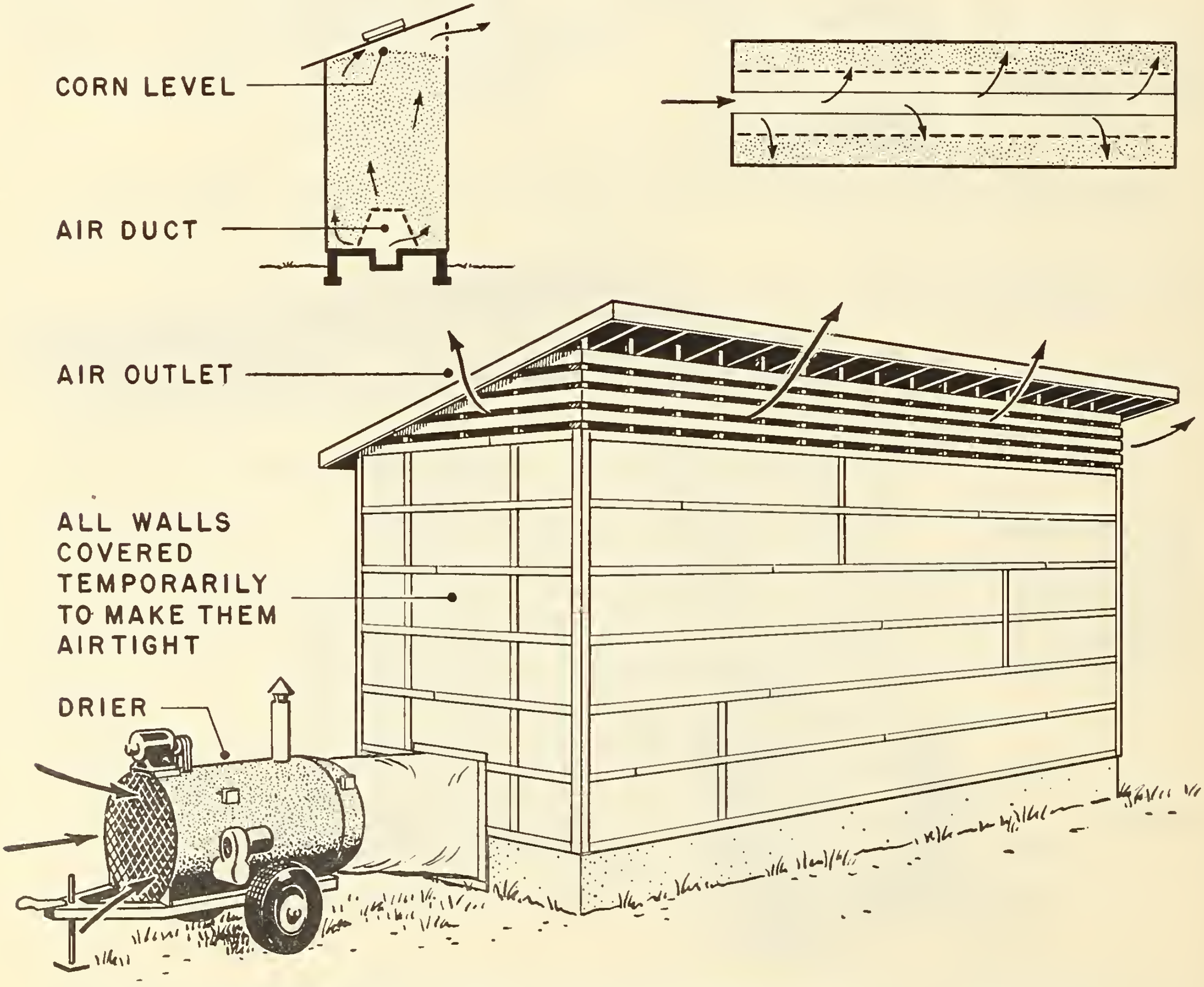


Figure 4.—*Air duct on inside of single crib. The crib is enclosed with canvas or reinforced paper.*

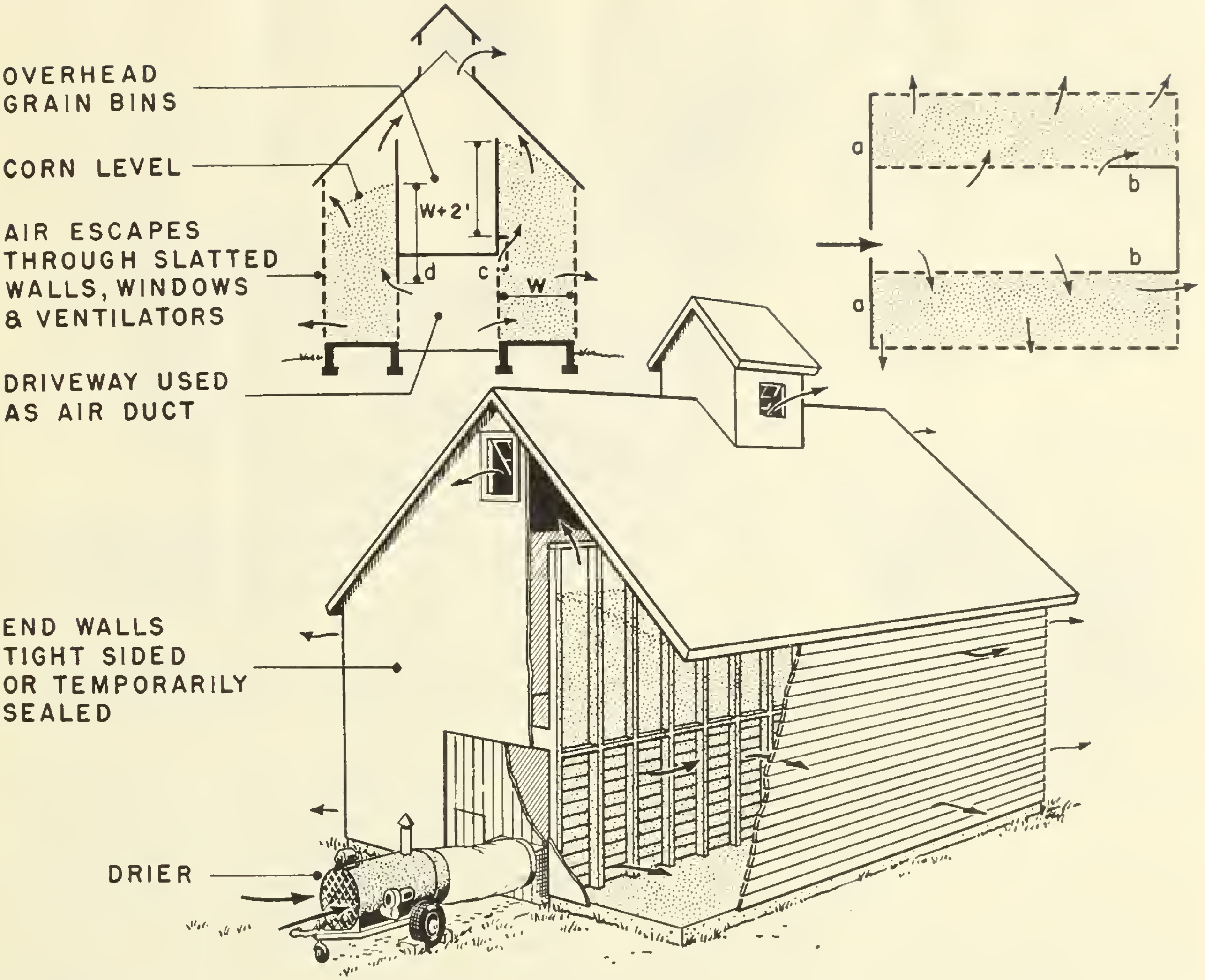

OVERHEAD GRAIN BINS
CORN LEVEL
AIR ESCAPES THROUGH SLATTED WALLS, WINDOWS & VENTILATORS
DRIVEWAY USED AS AIR DUCT
W+2'
d
c
W
a
b
b
a
END WALLS TIGHT SIDED OR TEMPORARILY SEALED
DRIER

Figure 5.—*Large rectangular double crib prepared for drying ear corn and equipped with drier to supply heated air.*

If the crib is only partly filled, and the height of corn above the bin floor is not 2 or 3 feet greater than the width of the crib, the upper part of the driveway wall should be covered as shown at *d* in figure 5 to provide an even flow of air through the corn.

Narrow alleyways in cribs of the type shown in figure 6 are used as air ducts and for unloading. The end walls of this type of crib must be tight, but use slats in the side walls and in the walls of the alleyway. This will permit both natural and mechanical ventilation.

Use of a slatted, removable air duct down the center of the driveway of the double crib shown in figure 7 permits filling of ear corn into both cribs and the driveway area. Set the duct on the driveway floor. Heated air blown into the duct flows outward and upward through the corn.

Installation of a duct or tunnel system will enable you to dry and store ear corn in a prefabricated general-purpose building of the type shown in figure 8. General-purpose buildings are made of either metal or wood. Some have straight sides instead of arched ribs.

A slatted inside wall must be installed to allow air to pass through the corn to the side walls of the bin. A slatted sectional air duct runs down the center of the floor.

You can use either snow fencing or welded wire to build a temporary circular crib of the type shown in figure 9. The heated-air entrance and main ducts must be installed before the crib is filled.

The prefabricated high round crib in figure 10

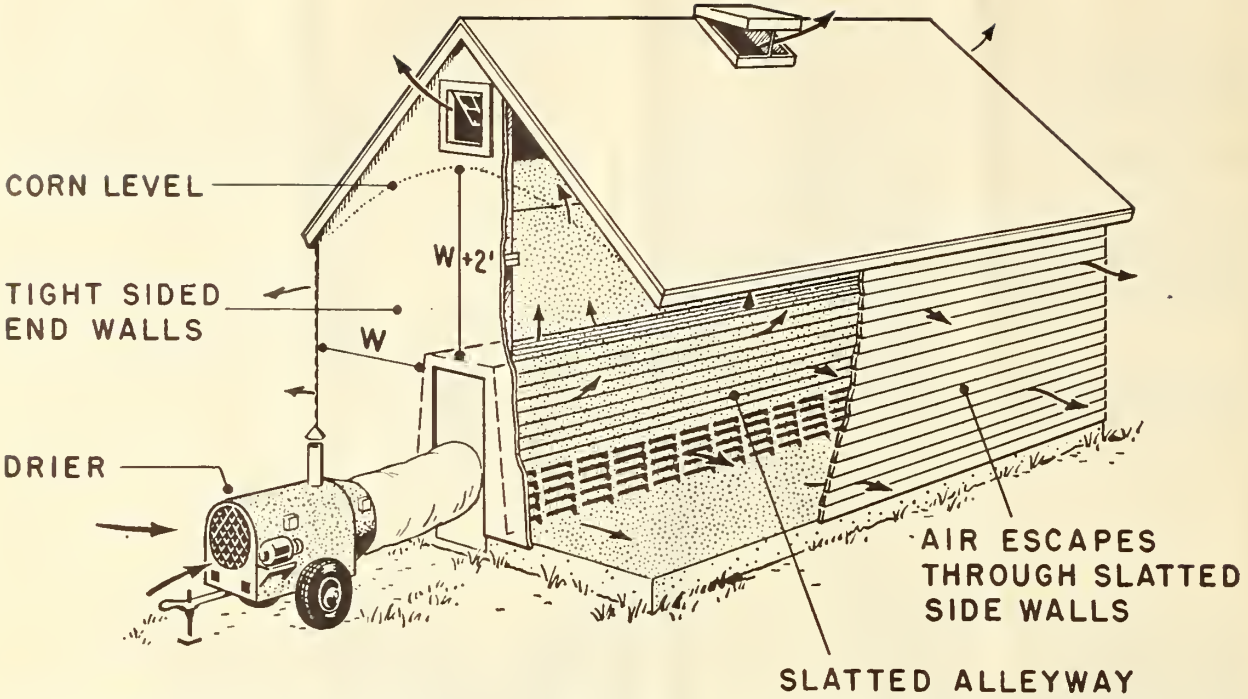


Figure 6.—*Wide crib with 4-foot alleyway. The alleyway is used as an air duct and also for unloading the crib.*

has perforated walls and a vertical, slatted main air duct that makes it readily adaptable to mechanical drying. If you fill the crib only partially, block the main air duct for more efficient drying. Place the blocking below the surface of the corn at a depth that is determined by adding 2 feet to the distance from duct to wall. Seal walls of the duct above the blocking to prevent a short circuit of the drying air. Use such materials as heavy pasteboard, plywood, or reinforced paper. If you decide to leave the crib only partially filled, you can fill the duct area above the blocking with corn to form a seal.

If you have an oval-type masonry crib such as shown in figure 11, a fairly uniform distribution of air is possible with the arrangement illustrated. Uniform distribution of air flow in this type of crib is difficult to obtain unless some special arrangement is provided for it. The vertical air duct shown inside the crib will help to provide a uniform air flow to the side walls and will also improve air circulation through the corn in the upper part of the crib, near the walls of the overhead grain bin.

The false floor of the circular metal bin shown in figure 12 is of perforated metal. Cover the floor evenly with ear corn at least 4 feet deep before starting the drier. Ear corn can be dried at depths up to 16 feet or even deeper. If a conveyor is to be used beneath the perforated floor, place this floor at least 16 inches above the ground or the permanent floor. Support the false floor on wood framing and concrete blocks or on other suitable supports. Place the blocks so that air can circulate through the openings. Provide one block for each 40 bushels (70 pounds per bushel) of ear corn or 50 bushels of grain that can be placed in the bin. Perforations should amount to at least 7 percent of the total area of the floor. You will find it best to mount the perforated floor in removable sections so that the space under the false floor can be cleaned easily. Several companies make perforated metal sheets that can be used for false floors. You can get plans for installing the floors from these companies. Perforated metal floors can also be used in other types of bins.

Hardware cloth can be used instead of perforated metal sheets as material for false floors in drying bins, as shown in figure 13. Place the concrete blocks so that air will circulate through them. Rows of blocks 4½ feet apart, with the blocks laid close together in the row, will support ear corn to a depth of 16 feet or shelled corn or grain to a depth of 9 feet.

If the drying bin is to be used for ear corn only, 1- by 6-inch slats laid flat across the rows of blocks

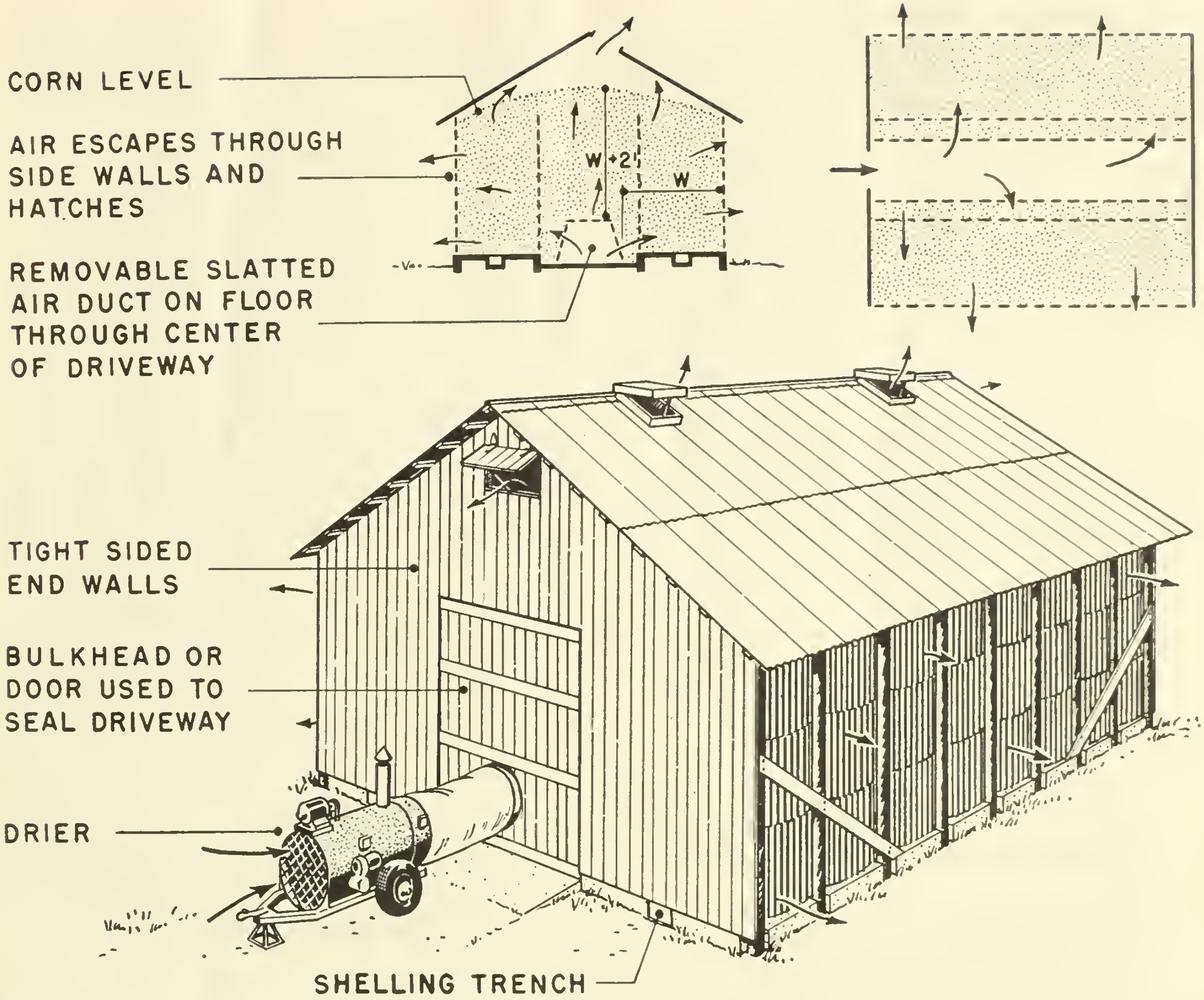

CORN LEVEL
AIR ESCAPES THROUGH SIDE WALLS AND HATCHES
REMOVABLE SLATTED AIR DUCT ON FLOOR THROUGH CENTER OF DRIVEWAY
W+2'
W
TIGHT SIDED END WALLS
BULKHEAD OR DOOR USED TO SEAL DRIVEWAY
DRIER
SHELLING TRENCH

Figure 7.—*Double crib without overhead bins, adapted for drying ear corn. Drier is attached for supplying heated air.*

and spaced ¾ inch apart may be substituted for the 2 by 4's and hardware cloth. Rows of blocks 2 feet apart, with the blocks 18 inches apart in the row, will support a 16-foot depth of ear corn. Use 2 by 8 sills as shown in figure 13.

A duct system that can be used when drying ear corn in rectangular or circular bins is shown in figure 14. For uniform air distribution the ear corn depth should be at least 6 feet. The main duct, shown in figure 14 outside the bin, could be located inside, along one side or at the center of the bin. Build the lateral ducts in about 4- to 6-foot sections so that you can remove them easily while emptying the bin. Details of construction of the duct system are shown in figure 15.

Construction details of a duct system that is suitable for use in several types of bins, as just described, are shown in figure 15. The main duct is usually rectangular in cross section, although it may be rounded or triangular. Allow 1 square foot of cross section area for each 1,000 c. f. m. of air flow from the fan. For example: If the fan delivers air at the rate of 9,000 c. f. m., the cross section area of the main duct should be at least 9 square feet. Such a duct could be 3 feet square. Provide small screened openings along the top of the main duct so air may pass upward to dry the corn above if inside the bin.

Space the lateral ducts so that the distance between them, center to center, is not more than half the depth of the ear corn to be dried. If all the lateral ducts are of the same length, you can compute the cross section area required for each by dividing the cross section area of the main duct by the number of laterals. For example: With 6 laterals of the same length and a cross section area of 9 square feet in the main duct, the area of each lateral is 9 divided by 6, or 1½ square feet. If such lateral ducts are built in rectangular form, two 1- by 10-inch boards, sufficiently braced, for the top and one 1- by 12-inch board for each side would be satisfactory. Laterals may be built triangular or rounded in shape.

The width of each lateral should be at least twice the height of its bottom edge above the floor. This height should be about 7 inches for a lateral spacing of 4 feet, center to center, and 10 inches high for a spacing of 6 feet. In any case, the total area for air passage under all the lateral ducts (height from floor to bottom of lateral times length of both sides and one end of each lateral) should be equal to at least one-fourth of the area of the bin floor.

If you use perforated metal sheets to make the laterals, and the sheets have uniformly spaced perforations equaling at least 10 percent of their total area, you may set laterals directly on the bin floor.

Uniform Air Flow

Corn settles from 1 to 3 feet as it dries. Unless allowance is made for settling, there will not be a uniform distribution of drying air through the grain. Too much drying air will pass through the corn above the main duct as it settles to a shallower depth as compared to the corn at the sides of the duct. You can allow for settling in cribs or bins with perforated or slatted walls by having the height of the corn above the top of the slatted air duct 2 feet greater than the distance from the duct to the wall. Also, where air enters or leaves the main duct through a side wall, fill above the top of the

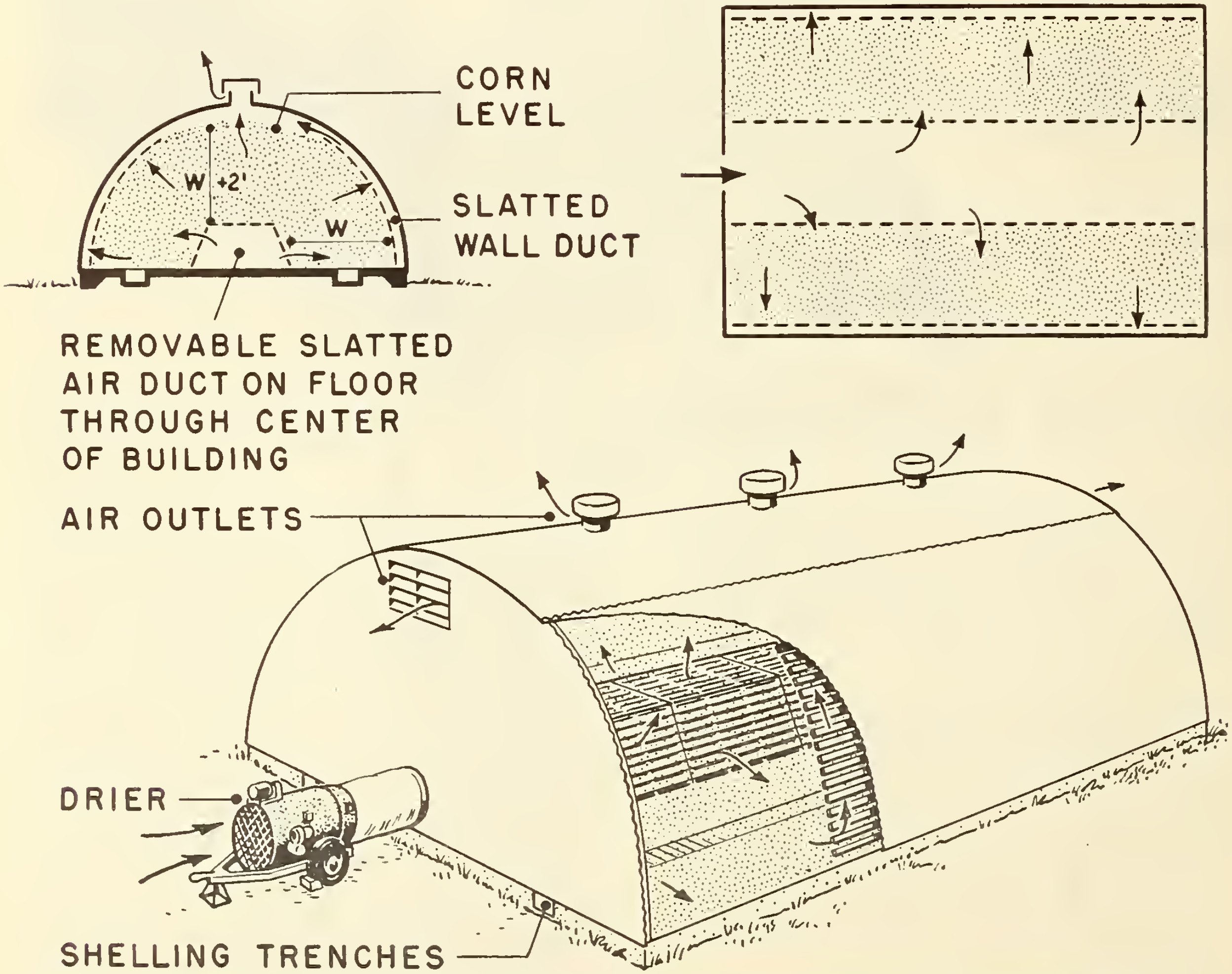


Figure 8.—*General-purpose building equipped with air duct and drier for drying ear corn with heated air.*

air inlet to a height 2 feet greater than the crib width. In cribs or bins with tight walls, settling does not affect uniform air flow if the perforated floor or ducts are covered with corn to an even depth.

Cross ties in cribs prepared as in figures 3, 5, 6, and 7 interfere with even distribution of the air. As the corn dries and settles, a channel forms under each cross tie. These channels permit air to escape from the crib without going through the corn above the cross ties. To reduce this loss, cover with paper a strip of the outside wall 2 to 4 feet wide at the level of the cross ties. If a shelling trench is not used as a main duct it should be covered with reinforced paper.

Where air enters the corn through a slatted side or top of the air duct, or through a perforated or slatted floor (all crib and bin illustrations except fig. 14), the slatted or perforated area should equal at least one-third of the floor area.

In some cases, it may be necessary or desirable to ventilate corn in a crib or bin that is only partly filled. With a perforated floor or floor ducts, drying may be started any time after the floor or the ducts are covered to a uniform depth. With the other arrangements shown, some modification of ducts or placement of corn may be necessary when the crib is only partly filled. In planning a drying set-up under such conditions, remember that the drying air should travel about the same distance through the corn in all parts of the crib.

Match Drier to Crib

A good match of size of drier to size of crib is essential for economical drying. Recommended crib sizes are shown in table 1.

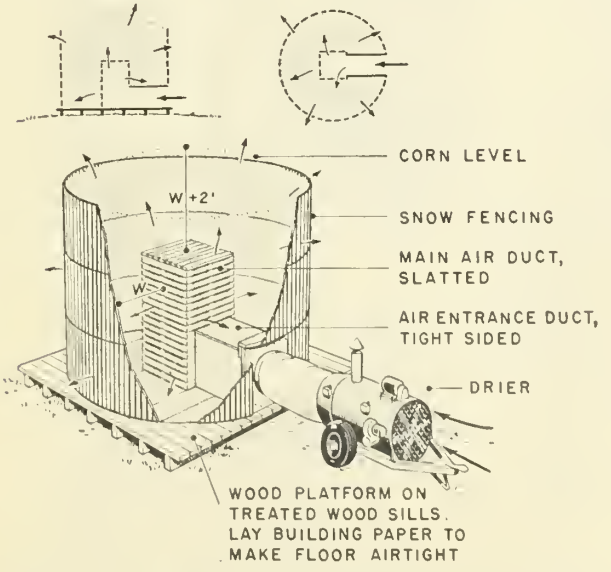

CORN LEVEL
W+2'
SNOW FENCING
MAIN AIR DUCT, SLATTED
W
AIR ENTRANCE DUCT, TIGHT SIDED
DRIER
WOOD PLATFORM ON TREATED WOOD SILLS. LAY BUILDING PAPER TO MAKE FLOOR AIRTIGHT

Figure 9.—*Inexpensive, easily built crib with drier.*

The size of batch or crib to match a given size of dryer will depend upon the drying-air temperature and the moisture content of the corn. Low temperatures of drying air result in slow drying and require large batches of corn for economical operation. High temperatures of drying air result in faster drying, permit more economical drying of smaller batches, and a wider range in batch sizes. A drier that can give an 80° rise in temperature can be adapted to a wide range of batch sizes under usual operating conditions (see table 1).

Temperature of Drying Air

A temperature rise of at least 60° F. is recommended if ear corn is to be dried in cool weather. Reference to table 1 will show some disadvantages when there is only a 40° temperature rise from an atmospheric temperature of 30° (to 70°). Under this condition larger batch sizes will be required for

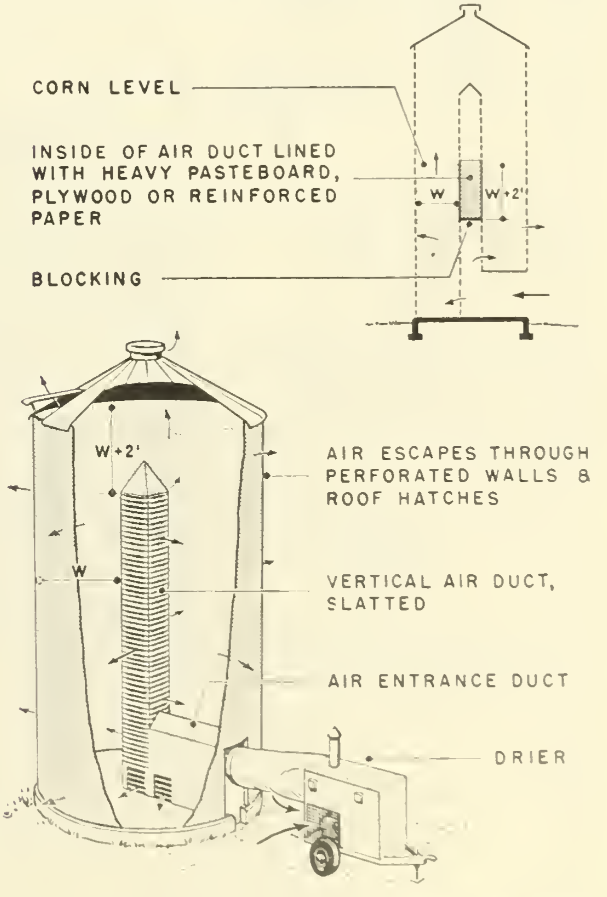

CORN LEVEL
INSIDE OF AIR DUCT LINED WITH HEAVY PASTEBOARD, PLYWOOD OR REINFORCED PAPER
W
W+2'
BLOCKING
W+2'
W
AIR ESCAPES THROUGH PERFORATED WALLS & ROOF HATCHES
VERTICAL AIR DUCT, SLATTED
AIR ENTRANCE DUCT
DRIER

Figure 10.—*High round crib with perforated walls. The main air duct in the center of the crib is vertical and slatted.*

Table 1.—*Recommended batch size to match different sizes of crop driers; and estimated time and fuel consumption required for drying ear corn from the moisture content stated down to 13 percent*

Air temperatures			Initial moisture content of kernels	Size of fan motor		Recommended batch size [2]	Estimated amount of fuel oil and time required to dry a batch to 13-percent moisture content, using—					Estimated amount of water that will be evaporated per gallon of fuel oil burned using—	
							A direct-heat drier		An indirect-heat drier [3]		Time per 1,000 bushels		
Atmosphere [1]	Amount of rise	Drying		Power rating	Rate of air delivery		Fuel consumption per hour	Fuel consumption for 1,000 bushels	Fuel consumption per hour	Fuel consumption for 1,000 bushels		A direct-heat drier	An indirect-heat drier
(° F.)	*(° F.)*	*(° F.)*	*Percent*	*Hp.*	*C. f. m.*	*Bushels*	*Gallons*	*Gallons*	*Gallons*	*Gallons*	*Hours*	*Pounds*	*Pounds*
30	40	70	30	3	9,000	1,500 to 1,800	3	500	4.2	700	167	43	30
			25			2,000 to 2,600		340		475	113		
			20			2,400 to 4,700		190		265	63		
60	40	100	30	3	9,000	1,000 to 1,500	3	310	4.2	430	103	70	50
			25			1,200 to 2,100		210		295	70		
			20			1,600 to 3,700		120		170	40		
30	80	110	30	3	9,000	950 to 2,400	6	440	8.4	615	73	50	35
			25			1,200 to 3,500		300		420	50		
			20			1,500 to 6,000		160		220	27		
60	80	140	30	3	9,000	700 to 1,800	6	330	8.4	460	55	66	47
			25			900 to 2,600		230		320	38		
			20			1,200 to 4,900		120		170	20		
30	40	70	30	5	15,000	2,600 to 3,000	5	500	7	700	100	44	30
			25			3,300 to 4,400		340		475	68		
			20			4,200 to 8,000		190		265	38		
60	40	100	30	5	15,000	1,600 to 2,400	5	310	7	430	62	70	50
			25			2,100 to 3,500		210		295	42		
			20			2,600 to 6,000		120		170	24		
30	80	110	30	5	15,000	1,600 to 4,000	10	440	14	615	44	50	35
			25			2,000 to 6,000		300		420	30		
			20			2,400 to 11,000		160		220	16		
60	80	140	30	5	15,000	1,200 to 3,000	10	330	14	460	33	66	47
			25			1,400 to 4,500		230		320	23		
			20			1,900 to 8,000		120		170	12		

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[1] Relative humidity 70 percent.

[2] If a larger quantity of ear corn is dried than the maximum recommended for each range, there may be some mold growth in that part of the batch that dries last. If a smaller quantity is dried than recommended, the amount of fuel required per 1,000 bushels will be greater than the estimates given in this table. For a batch half the size of the minimum recommended in each range, the fuel requirement per 1,000 bushels will be increased by about half.

[3] Total fuel consumption required to dry a batch averages approximately 40 percent more for an indirect-heat drier than for a direct-heat drier.

economical operation than with a greater temperature rise. Fuel consumption will be 10 to 15 percent higher than it would be under similar conditions but with a temperature rise of 80°; and the drying time will be longer. See also general recommendations on drying temperatures under item 4, page 3.

How Corn Dries

Ear corn which the incoming air strikes first dries faster than that on the exhaust side of the bin or crib. The driest corn may have dried to 6 to 8 percent moisture before the wettest dries below 20 percent. When mechanical drying has been completed the moisture content of the driest corn will be several percent less than that of the wettest corn. As an example, when the wettest corn has dried to 20 percent, the average moisture content of the batch may be anywhere from 13 to 18 percent, depending upon initial moisture, temperature of the drying air, and other conditions.

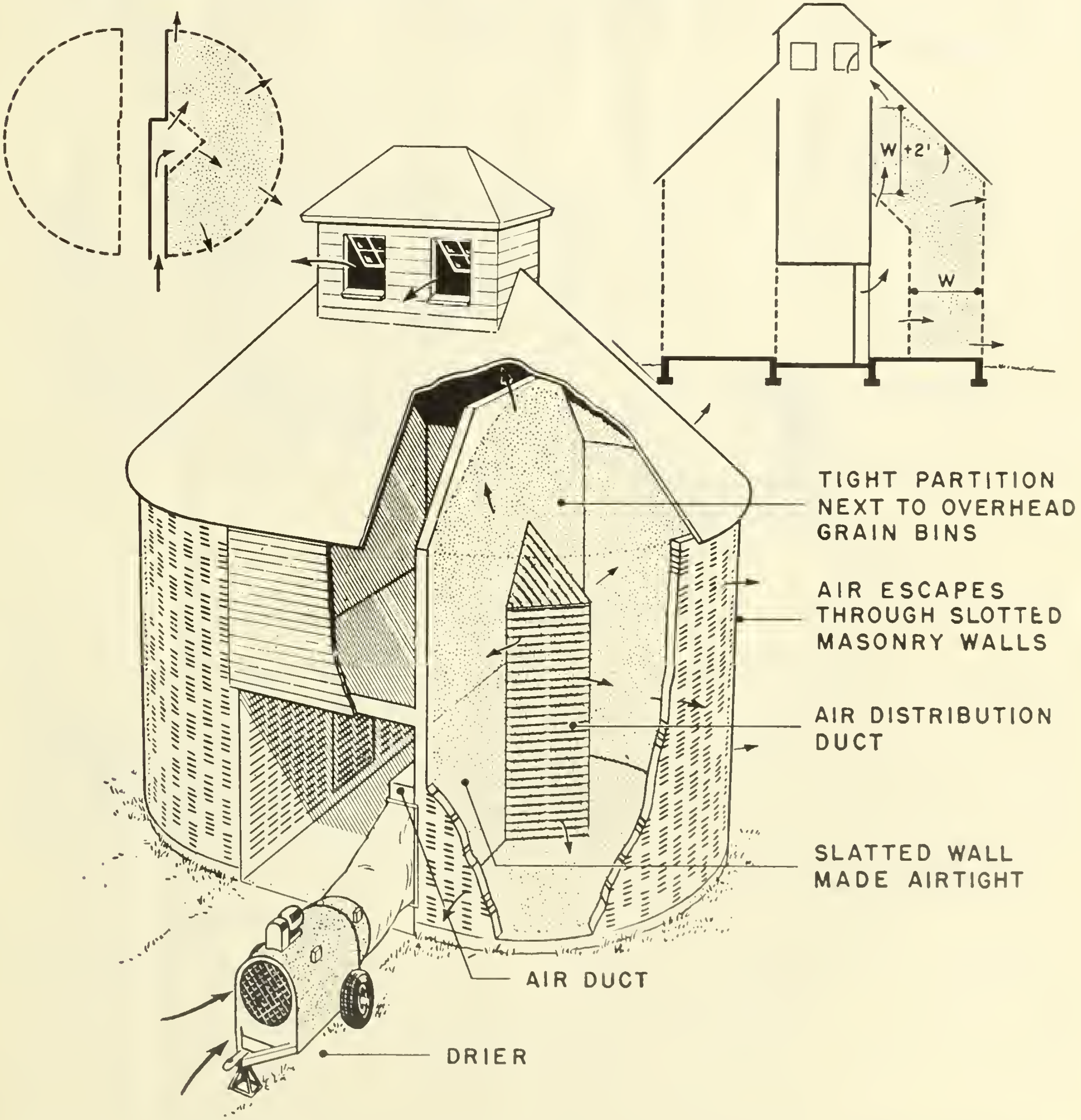
W+2'
W
TIGHT PARTITION NEXT TO OVERHEAD GRAIN BINS
AIR ESCAPES THROUGH SLOTTED MASONRY WALLS
AIR DISTRIBUTION DUCT
SLATTED WALL MADE AIRTIGHT
AIR DUCT
DRIER

Figure 11.—*Suggested arrangement of oval-type masonry crib for the mechanical drying of ear corn.*

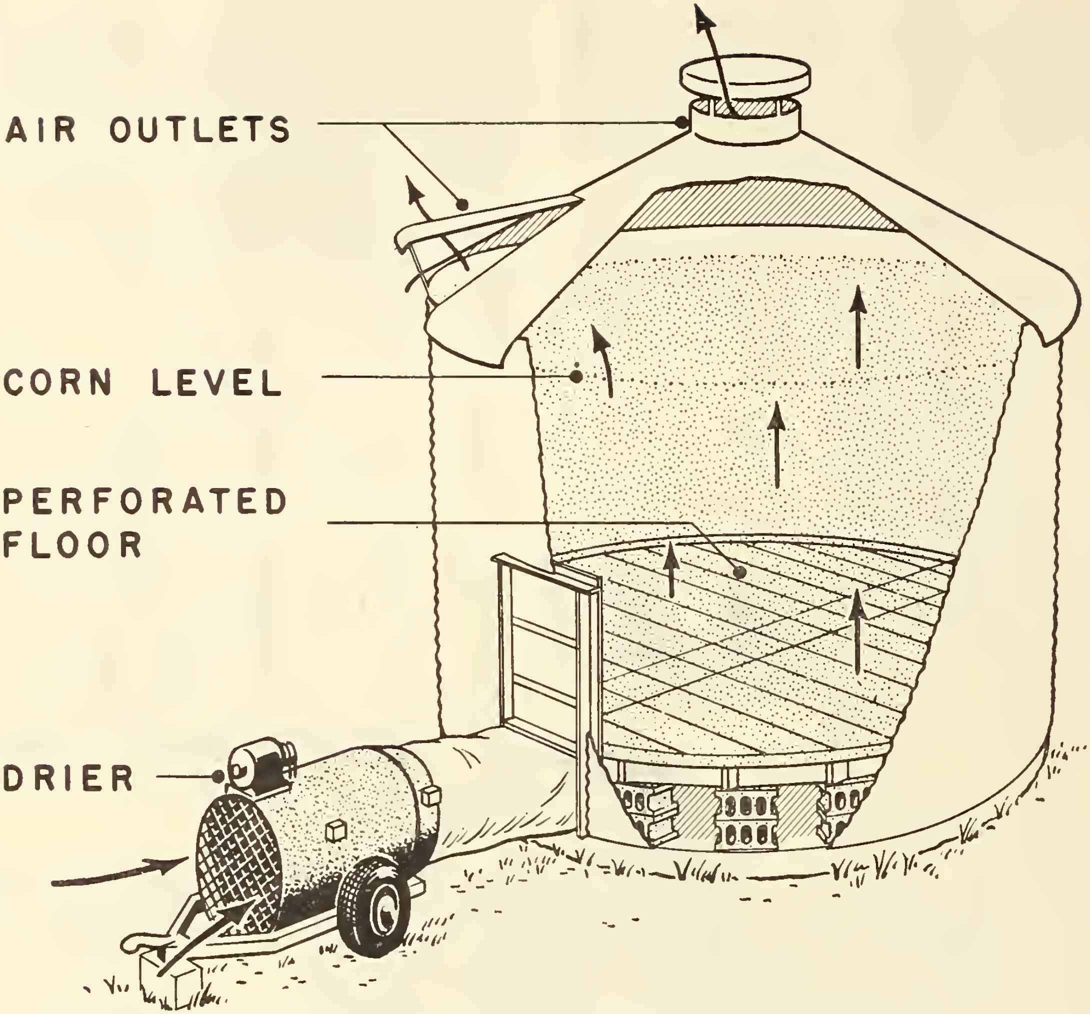

Figure 12.—*Circular metal bin with false floor of perforated metal.*

If corn is left in the crib, the overdried corn will regain some moisture from the atmosphere.

If the ear corn is to be shelled and then stored, shell it within a day or so after drying has been completed and before the corn has regained much moisture. In shelling, mix the corn thoroughly so that the moisture content will be uniform.

How To Tell When Corn Is Dry

A practical way to tell when a batch will be dry is to estimate the fuel requirement, as explained under "Cost of Drying." Stop drying when this quantity of fuel has been burned. Then take probe samples to find out how moist the corn is. The corn that is least dry will be at the top surface or at the crib wall, where drying air escapes. When this corn has a moisture content of 20 percent or less, the batch can be stored safely in a crib that has good natural ventilation.

If the corn is to be marketed immediately, it should not be dried to an average moisture content of less than 15½ percent unless a premium price is offered for corn of lower moisture content. If the corn is to be shelled and stored, the average moisture after drying should not be more than 13 percent.

Cost of Drying

The quantity of fuel oil needed to dry a batch of corn, and the operating time, can be estimated from table 1. The initial moisture content of the corn and temperature of outside air and of the drying air are not likely to correspond exactly to those shown in the table. So you will need to estimate, using the table as a guide. If the corn is not dried to an average moisture content as low as 13 percent, less fuel oil will be required to dry 1,000 bushels.

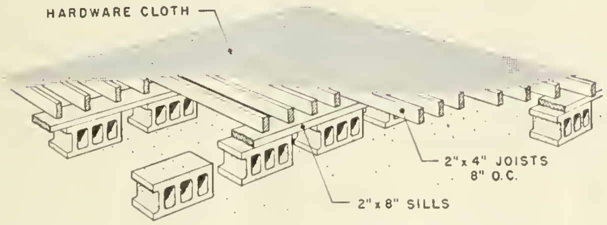

Figure 13.—*Details in use of hardware cloth as a false floor in a bin.*

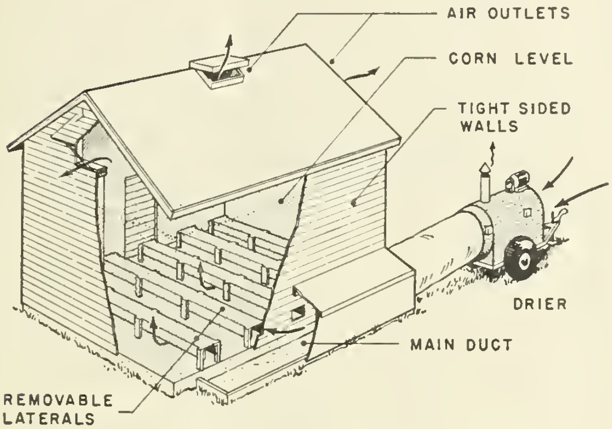

Figure 14.—*Rectangular bin with duct system.*

Other costs of drying besides that for fuel oil and labor of attendance will be for materials and labor for attaching the air duct and covering crib walls, for power to drive the fan, for insurance, repairs, and overhead cost of equipment—interest on investment, depreciation, and taxes. When drying corn from 25 percent moisture, the cost of fuel oil and power in the fall of 1952 may not exceed 5 cents per bushel, but when all other costs are included the total may be 10 cents or more per bushel. This cost will be less per bushel if the drier is used to dry large quantities of corn, as on a large farm or for several neighboring farms.

Weight Loss Caused by Moisture Reduction

Table 2 shows the weight of water in a bushel of ear corn at different percentages of moisture in the kernels. From these figures you can calculate the pounds of water that must be evaporated to dry ear corn from any initial moisture to any final moisture given in the table. Subtract the weight of water per bushel after drying from the weight of water per bushel at the start of drying. This information can be useful in deciding whether to sell damp corn and take a price discount for the high moisture content or to dry it and avoid the discount but have less weight to sell.

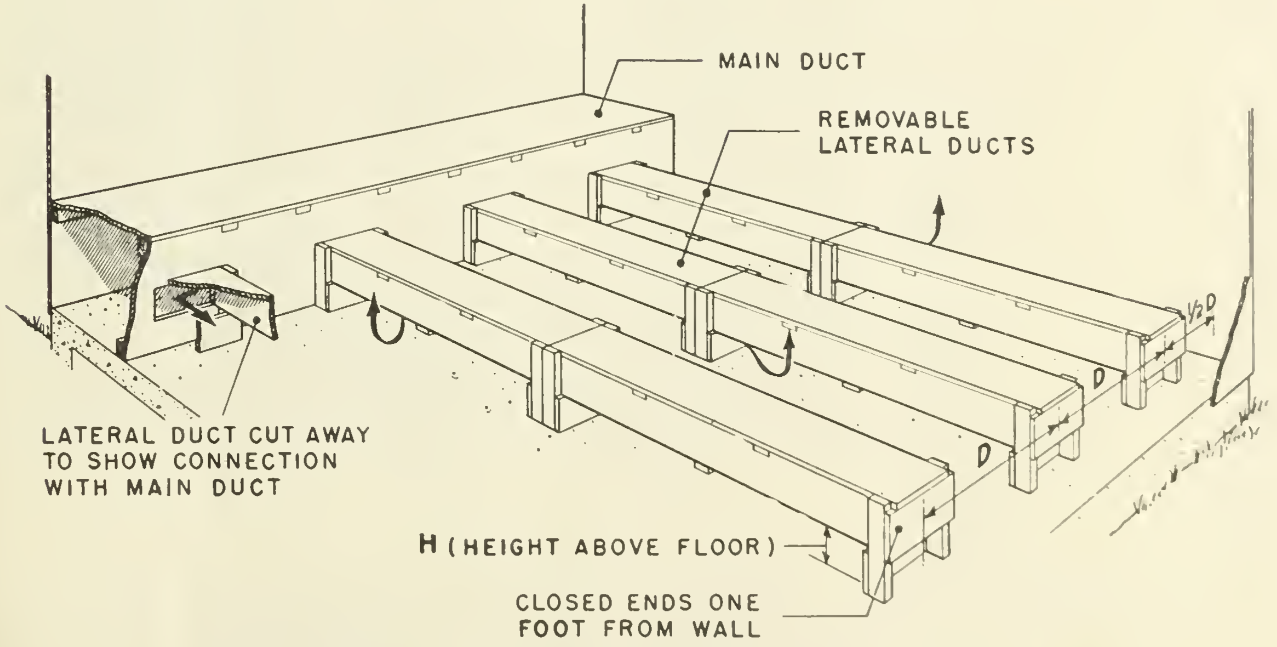
MAIN DUCT
REMOVABLE LATERAL DUCTS
½D
D
D
LATERAL DUCT CUT AWAY TO SHOW CONNECTION WITH MAIN DUCT
H (HEIGHT ABOVE FLOOR)
CLOSED ENDS ONE FOOT FROM WALL

Figure 15.—*Details of duct system for drying bin.*

Table 2 and the last 2 columns of table 1 may be used to estimate the fuel needed to dry corn of other moisture contents than shown in table 1. Multiply the difference in pounds of water per bushel before and after drying by the number of bushels and divide by the appropriate figures from table 1. For example; how many gallons of fuel will be required to dry 1,000 bushels of corn with 28 percent moisture to 16 percent average moisture using an indirect-heat drier when the atmospheric temperature is 60° F. and the drying air temperature is 100° F. (40° temperature rise). From table 2 the difference in pounds of water before and after drying is 27.2 less 11.1=16.1 pounds per bushel, or 16.100 pounds for 1,000 bushels. The last column of table 1 shows that about 50 pounds of water should be evaporated per gallon of fuel by an indirect-heat drier when the atmospheric temperature is 60° F. Dividing 16.100 by 50 shows that about 320 gallons of fuel will be needed.

Table 2.—*Approximate amount of water in ear corn, when harvested, at different percentages of moisture content of the kernels*

Kernel moisture content (percent)	Amount of water in a bushel of ear corn [1]		
	In kernels (pounds)	In cobs (pounds)	Total (pounds)
35	25. 5	12. 4	37. 9
30	20. 3	9. 9	30. 2
28	18. 4	8. 8	27. 2
26	16. 6	7. 8	24. 4
24	14. 9	6. 7	21. 6
22	13. 3	5. 5	18. 8
20	11. 8	4. 4	16. 2
18	10. 4	3. 2	13. 6
16	9. 0	2. 1	11. 1
14	7. 7	1. 4	9. 1
12	6. 5	0. 9	7. 4
10	5. 3	0. 5	5. 8

[1] A bushel of ear corn is defined here as the quantity that will yield 56 pounds of shelled corn at 15.5 percent moisture.

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